BEFORE THE
PUBLIC SERVICE COMMISSION OF
SOUTH CAROLINA

DOCKET NO. 2019-182-E

In the Matter of: South Carolina Energy Freedom Act (H.3659) Proceeding Initiated Pursuant to S.C. Code Ann. Section 58-40-20(C): Generic Docket to (1) Investigate and Determine the Costs and Benefits of the Current Net Energy Metering Program and (2) Establish a Methodology for Calculating the Value of the Energy Produced by Customer-Generators	)	**DIRECT TESTIMONY OF BRADLEY HARRIS FOR DUKE ENERGY CAROLINAS, LLC AND DUKE ENERGY PROGRESS, LLC**

I. INTRODUCTION AND SUMMARY

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Bradley ("Brad") Harris, and my business address is 411 Fayetteville Street, Raleigh, North Carolina 27601.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by Duke Energy Corporation as a Rates and Regulatory Strategy Manager, where I am responsible for managing strategic rate design reforms in the Carolinas and Florida.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I received a Bachelor's Degree in Political Science and Economics from Tufts University in 2013, a Master of Business Administration from the University of North Carolina Kenan-Flagler Business School in 2019 with concentrations in energy and corporate finance, and a Masters in Public Policy from Duke University's Sanford School of Public Policy in 2019. At Duke University, I received the Outstanding Master's Project Award for my consulting project for Duke Energy Corporation and my thesis, which was focused on residential rate design in North Carolina. From August 2014 – July 2015, I served as a registered lobbyist for the Friends Committee on National Legislation. From January 2016 – August 2016, I served as a Legislative Intern for Financial Services and Tax Policy with the United States Senate. In July 2019, after serving as a Graduate Fellow at the UNC School of Government and completing an MBA internship at Hannon Armstrong Sustainable Real Estate, I joined Duke Energy Corporation as a Senior

Pricing and Regulatory Solutions Analyst in July 2019. In January 2020, I assumed a new role with responsibilities covering strategic rate design projects.

Q. HAVE YOU TESTIFIED BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA (THE "COMMISSION") IN ANY PRIOR PROCEEDINGS?

A. No.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to analyze (i) certain cost of service implications (including whether net energy metering ("NEM") customers would provide an adequate rate of return as a separate customer class) and (ii) impacts on long-run costs, in each case, under NEM programs for Duke Energy Progress, LLC ("DEP") and Duke Energy Carolinas, LLC ("DEC") (DEP and DEC are together referred to as the "Companies").

Q. ARE YOU INCLUDING ANY EXHIBITS IN SUPPORT OF YOUR TESTIMONY?

A. No.

Q. PLEASE PROVIDE A BRIEF SUMMARY OF YOUR TESTIMONY.

A. In my testimony, I describe how the Companies leveraged existing data to fulfill Act 62's mandate to estimate the cost of service implications under the Companies' current NEM programs (collectively, the "Existing NEM Programs"). These cost of service implications manifest themselves in a cost-shift and subsidy borne by non-NEM customers. Finally, in accordance with Act 62, I describe how these NEM customers impact the Companies' long-term costs in a manner similar to (i)

qualifying facilities under the Public Utility Regulatory Policy Act of 1978, 16 U.S.C. §§ 2601, et seq. ("PURPA") and (ii) customers operating under energy efficiency or demand-side management programs.

II. ACT 62 REQUIREMENTS

Q. PLEASE DESCRIBE THE PORTION OF ACT 62'S COST-BENEFIT ANALYSIS THAT YOU WILL ADDRESS IN YOUR DIRECT TESTIMONY.

A. As described in Witness Brown's testimony, Act 62 requires the Commission to analyze costs and benefits related to certain aspects of the Existing NEM Programs. Act 62 enumerates specific factors to be considered by the Commission under this analysis. Although Witness Brown and Witness Huber will cover certain items in this analysis, I will address two of the factors required by the analysis in S.C. Code Ann. § 58-40-20(D)—cost of service implications and impact of NEM customers on certain of the Companies' long-run marginal costs.

Specifically, S.C. Code Ann. § 58-40-20(D)(2) requires the Companies to evaluate Existing NEM Programs to determine:

> [T]he cost of service implications of customer-generators on other customers within the same class, including an evaluation of whether customer-generators provide an adequate rate of return to the electrical utility compared to the otherwise applicable rate class when, for analytical purposes only, examined as a separate class within a cost of service study.

Additionally, S.C. Code Ann. § 58-40-20(D)(1) requires the Companies to evaluate the "aggregate impact of customer-generators on the electrical utility's long-run marginal costs of generation, distribution, and transmission" under Existing NEM

Programs. To address these specific portions of the cost-benefit analysis, I conducted detailed studies and analyses, as described below.

III. COST OF SERVICE IMPLICATIONS

Q. PLEASE DESCRIBE HOW THE COMPANIES EVALUATED THE COST OF SERVICE IMPLICATIONS REQUIRED BY ACT 62.

A. To evaluate the cost of service implications under Existing NEM Programs, as required by Act 62, I performed two studies—one for DEC and one for DEP (the "Embedded Cost to Serve Studies").

Q. PLEASE DESCRIBE THE PURPOSE OF THE EMBEDDED COST TO SERVE STUDIES.

A. The purpose of the Embedded Cost to Serve Studies was to estimate the electricity bill impacts on residential customers arising from customers taking service under Existing NEM Programs. There are certain bill impacts that have the potential to arise under any NEM program. These impacts include unwarranted cost-shifts—which occur when a customer pays less than the Companies' cost to serve that customer. When this occurs, these costs are recovered from other customers, creating a subsidy that decreases some customer bills while increasing others. The Embedded Cost to Serve Studies estimate the unwarranted and gross cost-shift to other residential customers from customers under the Existing NEM Programs. Likewise, the Embedded Cost to Serve Studies also reveal whether NEM customers would provide an adequate rate of return compared to the residential rate class if they were to be a separate class within a cost of service study. It should be noted that a goal of Act 236 was to establish and promote NEM. Therefore, the results

of this study provide empirical data on the Existing NEM Programs and provide context for measures in a successor tariff, but should not alone be viewed as a measure of success of the Existing NEM Programs or Act 236.

Q. PLEASE DESCRIBE THE DATA USED IN THE EMBEDDED COST TO SERVE STUDIES.

A. The Embedded Cost to Serve Studies primarily rely upon two existing data sets—(i) cost of service studies and (ii) production meter data. These are the cost of service studies that current rates are based upon and were derived from the 2018 rate cases for DEC and DEP in Docket Nos. 2018-318-E and 2018-319-E (the "2018 Studies"). As such, the 2018 Studies were utilized to establish the costs within the Embedded Cost to Serve Studies. The 2018 Studies use calendar year 2017 as a test year. Likewise, the production meter data that was used to establish solar profiles in the Embedded Cost to Serve Studies came from DEC production meter data for NEM customers in calendar year 2017. This DEC production meter data was used for both DEC and DEP given that no production meter data was available for DEP.

Q. WHY DID THE COMPANIES RELY UPON THE 2018 STUDIES IN PERFORMING THE EMBEDDED COST TO SERVE STUDIES?

A. Given that the 2018 Studies were utilized to develop current base rates, the Companies considered it appropriate to utilize costs from the 2018 Studies. Additionally, the relatively small number of existing NEM customers in each utility's jurisdiction would not allow for a large enough sample to be collected to conduct a new cost of service study examining NEM customers as a separate rate

class. As discussed in the Results and Discussion section, the Embedded Cost to Serve Studies still provide meaningful insight into what the Companies' rates of return would be if NEM customers were treated as a separate rate class.

Q. DID YOU APPLY ANY FILTERS TO THE PRODUCTION METER DATA UTILIZED IN CONJUNCTION WITH THE 2018 STUDIES?

A. Yes, two filters were applied. First, customers with less than nine months of interval data were excluded, ensuring sufficient data for a reliable annual analysis. Second, customers that generated less than 50% of gross load (i.e. "solar offset") were excluded. Customers with less than a 50% solar offset tend to have a load shape and billing determinants that are not representative of the Companies' expectations for future NEM customers. Typically, NEM customers install systems targeting an offset of at least 85%. Therefore, filtering out customers with less than a 50% offset was deemed appropriate, and this only resulted in a 6% decrease in customers.

Q. HOW DOES THE PRODUCTION METER DATA COMPARE TO AN AVERAGE CUSTOMER IN DEC OR DEP?

A. Customers that decide to install rooftop solar consume, on average, consume more energy than the average customer. For both DEC and DEP, the average customer consumes roughly 1,050 kWh per month, while the average NEM customer in the production meter sample consumes roughly 20% more per month prior to installation of solar than a typical customer. Thus, while NEM customers may import less kWhs from the grid because of solar generation self-consumption, typical gross usage—the total usage taking into account imports and self-

consumption—is demonstrably higher than the average customer.

Q. PLEASE EXPLAIN THE METHODOLOGY USED IN THE EMBEDDED COST TO SERVE STUDIES.

A. The Embedded Cost to Serve Studies employed a seven-step process:

1. Unit costs were derived from the 2018 Studies. Unit costs were analyzed for customer costs, energy costs, distribution demand costs, transmission demand costs, and production demand costs. For example, the 2019 Studies identified customer unit costs in excess of $24.50 per customer. Therefore, if a customer had zero energy usage in DEC, the monthly cost to serve would be equal to the customer unit cost (i.e. in excess of $24.50). This can be extrapolated to mean that the cost to serve each additional customer is also the customer unit cost (i.e. in excess of $24.50). Similarly, the energy unit cost in DEC implies that every additional kWh consumed by a residential customer incurs that cost per kWh.
2. Each unit cost was then multiplied by appropriate determinants to generate an estimated cost to serve for a representative customer both with and without rooftop solar. For example, to estimate energy costs, the energy unit cost would be multiplied by imports if the customer did not have solar generation. The same calculation would be done with the energy unit cost multiplied by the imports if the customer has solar generation. The estimated energy costs with and without solar can be compared to arrive at the total energy cost savings that are attributable to the addition of solar generation. This process was repeated for each unit cost to create a complete estimate for the costs the Companies incur for serving these customers with and without solar generation.

3. Energy exports from NEM customers reduce system generation costs. These credits were valued using the energy unit cost rate. Line losses were not considered for this analysis because such losses are typically *de minimis*.
4. Several adjustments to the cost to serve estimate were made to account for costs recovered through current rider rates. The unit cost rates referred to above include the total costs of fuel, environmental Distributed Energy Resource Program avoided costs, and the capacity related costs, which include the PURPA purchased power capacity cost factors as approved in Docket No. 2017-3-E for DEC (implemented on October 1, 2017) and Docket No. 2018-1-E for DEP (implemented on July 1, 2018). Therefore, an additional adjustment was made to calculate these costs under current rates.
5. Using the output from steps 1-4, the difference in cost to serve for solar generators with and without solar generation was calculated.
6. Production meter data was put through a SAS model to estimate bills with and without solar generation. The difference constitutes savings the customer would experience by installing solar generation and net metering. The bill reduction under the Existing NEM Programs was estimated to be in a range that exceeds $1,250,00 in DEP. The bill reduction in DEC was estimated to be in a range that exceeds $1,250 for Schedule RS and $1,150 for RE.
7. Finally, the Embedded Cost to Serve Studies estimated unwarranted cost-shift by comparing the bill reduction from solar to the cost to serve reduction from solar. If there is no cost shift associated with NEM, the revenue reduction would equal the bill reduction. When bill reductions exceed cost of service

benefits, NEM customers are benefitting at the expense of non-NEM customers who must cover the shortfall in revenue requirements. Similarly, where cost of service benefits exceed bill reductions, non-NEM customers are benefitting from the installation of solar and NEM customers experience a bill reduction smaller than the value provided to the system.

IV. RESULTS OF EMBEDDED COST TO SERVE STUDIES

Q. PLEASE DISCUSS THE RESULTS OF THE COST SAVINGS DUE TO THE ADDITION OF SOLAR.

A. Adding solar had different effects based on the cost classification or functionalization analyzed:

- Customer Costs – adding solar did not reduce any customer costs since costs such as metering, a service drop, and a minimum distribution system exist regardless of the installation of solar. However, incremental billing costs—which are customer costs—were not included.
- Energy Costs – adding solar reduced energy costs for the Companies in a range of 20-40% as the customer's generation resulted in a reduction in the number of kWh's imported from the grid.
- Distribution Demand Costs – adding solar reduced distribution demand costs by less than 10%. Distribution demand costs are driven by local peaks specific to an individual or a subsection of individual customers. Solar only results in a small reduction in these costs because these local peaks often occur during times when solar generation is not producing

a material amount of energy.

- Transmission and Production Demand Costs – adding solar reduced the transmission and production costs of the Companies in excess of 75%. These costs are driven by the system peak. The system peak for DEC in 2017 occurred on August 17 from 2 p.m. to 3 p.m. The system peak for DEP in 2017 occurred on July 13 from 4 p.m. to 5 p.m. While it is possible that this hour was not as conducive to solar generation as the DEC peak, the DEC peak was used for the DEP model since production meter data was only available for NEM customers in DEC. Therefore, the DEP model also used the production meter data and associated system peak from DEC. Using DEC data for this purpose, which is based on an earlier afternoon hour, would likely increase the estimated impact of solar installed in DEP on transmission and production costs.

Q. PLEASE DESCRIBE AND EXPLAIN THE EXPECTED RESULTS OF THE EMBEDDED COST TO SERVE STUDY.

A. Under both DEC's and DEP's standard residential rate schedules (RS, RE, and RES), there is a fixed customer charge and a volumetric charge (per kWh). Such rate structures work well for customers whose total energy usage and demands are similarly correlated to cost to serve within the customer class. In other words, a standard high-usage customer is also likely to be a high-demand customer. Thus, the standard rate schedule will appropriately increase the customer's bill as usage increases. However, adding solar generation fundamentally decouples the relationship between energy usage and demand. An NEM customer's reduction in

maximum demand will not be as great as the corresponding reduction in energy usage. For example, in the sample of NEM customers used for this analysis, energy imports were reduced by an estimated amount within the range of 20-40%, while maximum demand was only slightly reduced by less than 10%. To understand why, consider the load of a residential customer early on a summer South Carolina evening, with air conditioning usage remaining high while solar production fades. The current policy of netting imported and exported kWh on a monthly basis with excess exports being able to carry forward to the next month (except in March, when cash-outs of excess energy occur) is not reflective of how the grid works. This creates more opportunities for the bills of NEM customers to diverge from the actual cost to serve such NEM customers. Based upon the above, there is a cross-subsidy under the current NEM policies, which is estimated to be in the range of $30-$60/month.

Q. ASSUMING NEM CUSTOMERS WERE THEIR OWN CUSTOMER CLASS, WOULD THEY PROVIDE AN ADEQUATE RATE OF RETURN TO THE COMPANIES?

A. No. If NEM customers formed a separate customer class, any current cost-shift could not be recovered from other residential customers. Without any non-NEM customers to offset the shortfall in revenue, this NEM customer class would not be able to provide an adequate rate of return to the electrical utility. In a hypothetical rate case, the NEM rate class would be allocated rate increases in excess of the average retail increase to provide an adequate rate of return for the class. In other

words, additional revenue would need to be recovered from the NEM rate class in order to provide an adequate rate of return.

V. EFFECTS OF SOLAR ON THE COMPANIES' LONG-RUN MARGINAL COSTS

Q. PLEASE EXPLAIN THE DIFFERENCE BETWEEN THE EMBEDDED COST TO SERVE STUDIES AND THE LONG-RUN MARGINAL COSTS INCURRED BY THE COMPANIES.

A. As described above, Act 62 requires the Commission to consider "the aggregate impact of customer-generators on the electrical utility's long-run marginal costs of generation, distribution, and transmission." This framework requires an analysis of marginal costs, which are fundamentally different from the costs examined in the Embedded Cost to Serve Studies. Marginal costs reflect the cost of the utility providing an additional unit—the cost of producing an additional kWh, for example. Marginal costs normally have not be incurred yet, meaning that the analysis is forward-looking. In contrast, embedded cost analyses look at historical costs that have already occurred. Additionally, marginal costs and embedded costs for the same item or service may vary due to time-dependent pricing fluctuations.

Q. HOW DO YOU PROPOSE TO QUANTIFY THE AGGREGATE IMPACT OF CUSTOMER-GENERATORS ON THE COMPANIES' LONG-RUN MARGINAL COSTS OF GENERATION, DISTRIBUTION, AND TRANSMISSION?

A. Excess energy exported to the grid by customer-generators has a similar effect on the utility's costs as qualifying facilities under PURPA that are connected to the secondary distribution system. The avoided cost provided by these exports is

determined via the methodology approved in the Companies' most recent avoided cost dockets—Docket Nos. 2019-185-E and 2019-186-E. Therefore, the same value should be applied to exports from customer-generators. Similarly, if a customer consumes energy from their solar generator behind the meter, the effect on the Companies' operations and costs is the same as if the customer reduced their consumption through an energy efficiency or demand-side management program.[1]

VI. CONCLUSION

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes, it does.

[1] DEP's Application for Approval of Rider DSM/EE-12 is currently under consideration by the Commission in Docket No. 2020-176-E. The Commission approved DEC's Rider DSM/EE-12 in Order No. 2020-593 on September 16, 2020.